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Installation, Start-Up, and Operating Instructions

Sizes 050—135, Series 151 and 161

NOTE: Read the entire instruction manual before starting the installation.

This symbol → indicates a change since the last issue.

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REGISTERED QUALITY SYSTEM

SAFETY CONSIDERATIONS

Installing and servicing heating equipment can be hazardous due to gas and electrical components. Only trained and qualified personnel should install, repair, or service heating equipment.

Untrained personnel can perform basic maintenance functions such as cleaning and replacing air filters. All other operations must be performed by trained service personnel. When working on heating equipment, observe precautions in the literature, on tags, and on labels attached to or shipped with the unit and other safety precautions that may apply.

In the United States, follow all safety codes including the National Fuel Gas Code (NFGC) NFPA 54-1999/ANSI Z223.1-1999 and the Installation Standards, Warm Air Heating and Air Conditioning Systems (NFPA 90B) ANSI/NFPA 90B.

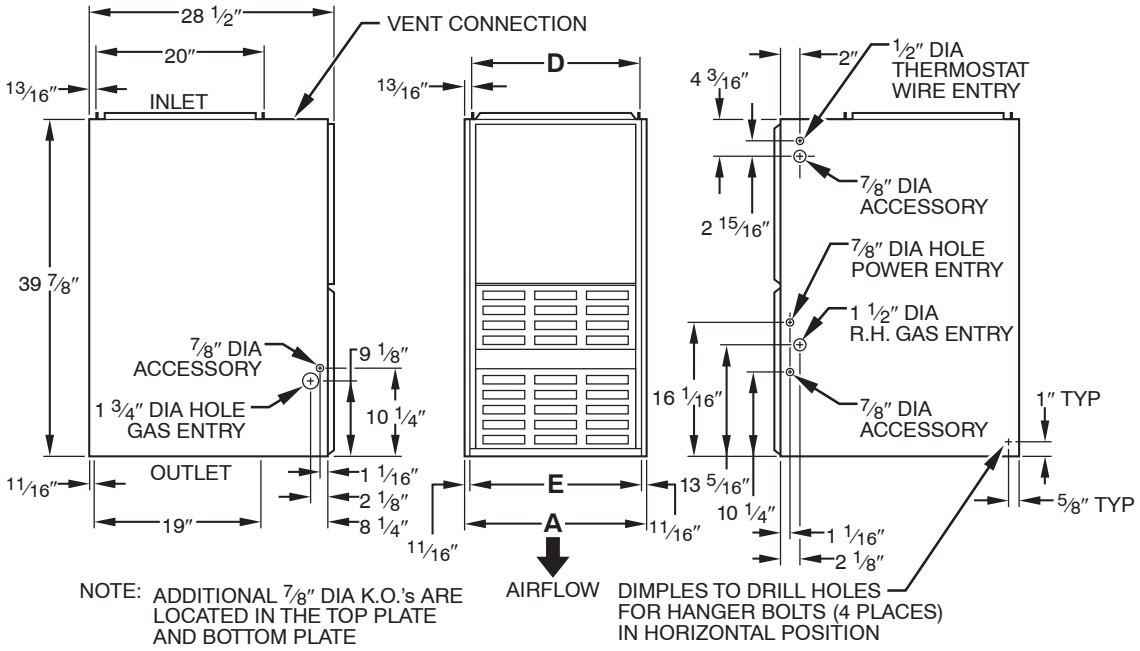
In Canada, refer to the CAN/CGA-B149.1- and .2-M95 National Standard of Canada, Natural Gas and Propane Installation Codes (NSCNGPIC).

Wear safety glasses and work gloves. Have fire extinguisher available during start-up and adjustment procedures and service calls.

Recognize safety information. This is the safety-alert symbol ⚠. When you see this symbol on the furnace and in instructions or manuals, be alert to the potential for personal injury.

Understand the signal words DANGER, WARNING, CAUTION, and NOTE. These words are used with the safety-alert symbol. DANGER identifies the most serious hazards which **will** result in severe personal injury or death. WARNING signifies a hazard which **could** result in personal injury or death. CAUTION is used to identify unsafe practices which **would** result in minor personal injury or product and property damage. NOTE is used to highlight suggestions which **will** result in enhanced installation, reliability, or operation.

These instructions cover minimum requirements and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept up with changing residential construction practices. We require these instructions as a minimum for a safe installation.



NOTE: Minimum return-air openings at furnace, based on metal duct. If flex duct is used, see flex duct manufacturer's recommendations for equivalent diameters.

a. For 800 CFM–16-in. round or 14½ x 12-in. rectangle.
b. For 1200 CFM–20-in. round or 14½ x 19½-in. rectangle.
c. For 1600 CFM–22-in. round or 14½ x 23¼-in. rectangle.
d. For airflow requirements above 1800 CFM, must use entire return air opening.

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Fig. 1—Dimensional Drawing

Table 1—Dimensions (In.)

UNIT SIZE	A	D	E	VENT CONN	SHIP. WT (LB)
050-08	14-3/16	12-9/16	12-11/16	4	124
050-12	14-3/16	12-9/16	12-11/16	4	128
070-08	14-3/16	12-9/16	12-11/16	4	129
070-12	14-3/16	12-9/16	12-11/16	4	137
096-12	17-1/2	15-7/8	16	4	146
096-16	17-1/2	15-7/8	16	4	151
115-16	17-1/2	15-7/8	16	4	159
115-20	21	19-3/8	19-1/2	4	174
115-22	21	19-3/8	19-1/2	4	176
135-20	24-1/2	22-7/8	23	5	193

ELECTROSTATIC DISCHARGE (ESD) PRECAUTIONS PROCEDURE

⚠ CAUTION

Electrostatic discharge can affect electronic components. Take precautions during furnace installation and servicing to protect the furnace electronic control. Precautions will prevent electrostatic discharges from personnel and hand tools which are held during the procedure. These precautions will help to avoid exposing the control to electrostatic discharge by putting the furnace, the control, and the person at the same electrostatic potential.

1. Disconnect all power to the furnace. DO NOT TOUCH THE CONTROL OR **ANY** WIRE CONNECTED TO THE CONTROL PRIOR TO DISCHARGING YOUR BODY'S ELECTROSTATIC CHARGE TO GROUND.
2. Firmly touch a clean, unpainted, metal surface of the furnace chassis which is close to the control. Tools held in a person's hand during grounding will be satisfactorily discharged.
3. After touching the chassis you may proceed to service the control or connecting wires as long as you do nothing that recharges your body with static electricity (for example; DO NOT move or shuffle your feet, DO NOT touch ungrounded objects, etc.).
4. If you touch ungrounded objects (recharge your body with static electricity), firmly touch furnace again before touching control or wires.
5. Use this procedure for installed and uninstalled (ungrounded) furnaces.
6. Before removing a new control from its container, discharge your body's electrostatic charge to ground to protect the control from damage. If the control is to be installed in a furnace, follow items 1 through 5 before bringing the control or yourself into contact with the furnace. Put all used AND new controls into containers before touching ungrounded objects.
7. An ESD service kit (available from commercial sources) may also be used to prevent ESD damage.

MINIMUM INCHES CLEARANCE TO COMBUSTIBLE CONSTRUCTION

This forced air furnace is equipped for use with natural gas at altitudes 0-10,000 ft (0-3,050m).

An accessory kit, supplied by the manufacturer,shall be used to convert to propane gas use or may be required for some natural gas applications.

This furnace is for indoor installation in a building constructed on site.

This furnace may be installed on combustible flooring in alcove or closet at minimum clearance from combustible material.

This furnace may be used with a Type B-1 Vent and may be vented in common with other gas-fired appliances.

† For installation on non-combustible floors only.
For installation on combustible flooring only when installed on special base, Part No. KGASB0201ALL, Coil Assembly, Part No. CD5 or CK5, or Coil Casing, Part No. KCAKC.

For furnaces wider than 14.25 inches (362mm) may be 0 inches.

Ø 18 inches front clearance required for alcove.

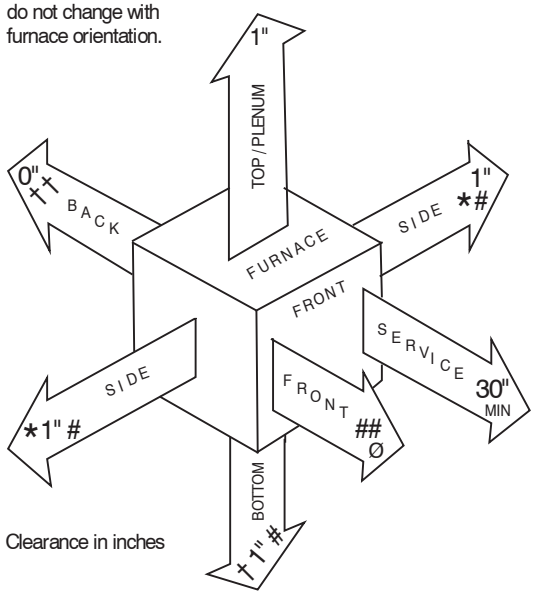
* Indicates supply or return sides when furnace is in the horizontal position. Line contact only permissible between lines formed by intersections of the Top and two Sides of the furnace jacket, and building joists, studs or framing.

For single wall vent type 6 inches.
For Type B-1 vent type 3 inches.

†† Clearance to Back 0 inches in downflow and horizontal (attic/alcove & crawlspace) positions and 3 inches in horizontal closet positions.

This furnace is approved for DOWNFLOW and HORIZONTAL installations.

Clearance arrows do not change with furnace orientation.



Clearance in inches

Vent Clearance to combustibles:
For Single Wall vents 6 inches.
For Type B-1 vent type 1 inch .

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Fig. 2—Clearances to Combustibles

INTRODUCTION

The model 58ZAV Series 151 and 161 Furnaces are available in sizes 46,000 through 135,000 Btuh input capacities.

The design of the downflow/horizontal gas-fired furnace is CSA (A.G.A. and C.G.A.) certified for natural and propane gases and for installation on noncombustible flooring. The furnace is factory-shipped for use with natural gas. A factory accessory gas conversion kit, as listed on the furnace rating plate is required to convert furnace for use with propane gas.

These furnaces SHALL NOT be installed directly on carpeting, tile, or any other combustible material other than wood flooring. In downflow installations, a factory accessory floor base, as listed on the furnace rating plate MUST be used when installed on combustible materials and wood flooring. A factory base is not required when this furnace is installed on manufacturer's Coil Assembly Part No. CD5 or CK5, or when Coil Box Part No. KCAKC is used. This furnace is for installation in alcoves, attics, crawlspaces, basements, closets, or utility rooms. The design of this furnace line is **not** CSA (A.G.A. and C.G.A.) certified for installation in mobile homes, recreation vehicles, or outdoors.

Before installing the furnace in the United States, refer to the current edition of the NFGC and the NFPA 90B. For further information, the NFGC and NFPA 90B are available from National Fire Protection Association Inc., Batterymarch Park, Quincy, MA 02269; or the American Gas Association, 400 N. Capitol St., NW, Washington DC 20001.

Before installing the furnace in Canada, refer to the current edition of the NSCNGPIC. For a copy of the NSCNGPIC, contact Standard Sales, CSA International, 178 Rexdale Boulevard, Etobicoke (Toronto), Ontario, M9W 1R3, Canada.

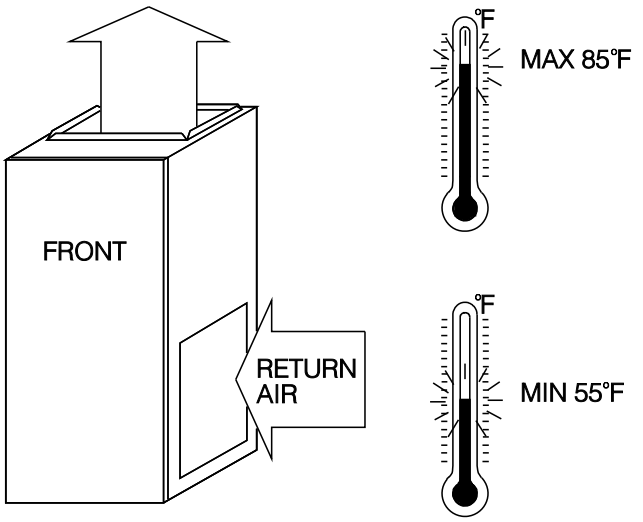
Installation must comply with regulations of serving gas supplier and local building, heating, plumbing or other codes in effect in the area in which installation is made. In absence of local building codes, installation must conform with NFGC in the United States and the NSCNGPIC and all authorities having jurisdiction in Canada.

These instructions cover minimum requirements for a safe installation and conform to existing national standards and safety codes. In some instances, these instructions exceed certain local codes and ordinances, especially those that may not have kept pace with changing residential construction practices. We require these instructions as a minimum for a safe installation.

⚠ CAUTION

Application of this furnace should be indoors with special attention given to vent sizing and material, gas input rate, air temperature rise, and unit sizing. Improper installation or misapplication of the furnace can require excessive servicing or cause premature component failure.

NOTE: These furnaces are designed for a minimum continuous return-air temperature of 60°F or intermittent operation down to 55°F such as when used with a night setback thermostat. Return-air temperature must not exceed a maximum of 85°F. Failure to follow these return-air temperature limits may affect reliability of heat exchangers, motors, and controls.



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⚠ WARNING

Improper installation, adjustment, alteration, service, maintenance, or use can cause carbon monoxide poisoning, explosion, fire, electrical shock, or other conditions which may cause personal injury, loss of life, or property damage. Consult a qualified installer, service agency, local gas supplier, or your distributor or branch for information or assistance. The qualified installer or agency must use only factory-authorized and listed kits or accessories when modifying this product. Failure to follow this warning could result in electrical shock, fire, personal injury, or death.

For accessory installation details, refer to the applicable installation literature.

NOTE: Remove all shipping brackets and materials before operating the furnace.

Step 1—Location

GENERAL

⚠ CAUTION

Do not install furnace in a corrosive or contaminated atmosphere. Make sure all combustion and circulating air requirements are followed, in addition to all local codes and ordinances.

Do not use this furnace during construction when adhesives, sealers, and/or new carpets are being installed. If the furnace is required during construction, use clean outside air for combustion and ventilation. Compounds of chlorine and fluorine when burned with combustion air form acids which cause corrosion of the heat exchangers and metal vent system. Some of these compounds are found in paneling and dry wall adhesives, paints, thinners, masonry cleaning materials, and many other solvents commonly used in the construction process.

Excessive exposure to contaminated combustion air will result in safety and performance related problems.

⚠ WARNING

DO NOT install the furnace on its back; safety control operation will be adversely affected. Failure to follow this warning could result in fire, personal injury, or death.

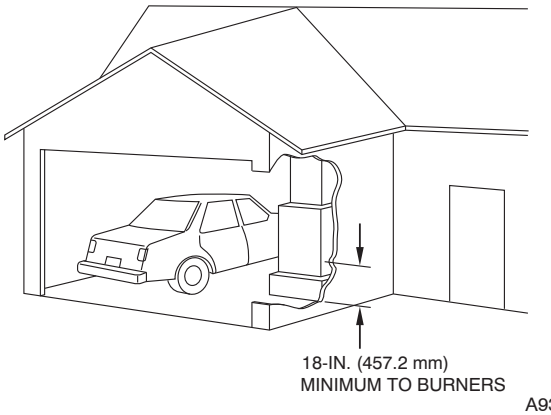
This furnace must be installed so the electrical components are protected from water.

Locate the furnace as close to the chimney/vent and as near the center of the air distribution system as possible. The furnace should be installed as level as possible.

Provide ample space for servicing and cleaning. Always comply with the minimum fire protection clearances shown on the unit rating plate. This furnace shall not be installed directly on carpeting, tile, or any combustible material other than wood flooring. The furnace may be installed on combustible flooring when installed with the accessory downflow subbase, which is available from your distributor or branch when required.

LOCATION RELATIVE TO COOLING EQUIPMENT — The cooling coil must be installed parallel with or on the downstream side of the furnace to avoid condensation in the heat exchangers. When installed parallel with a furnace, dampers or other means used to control the flow of air must prevent chilled air from entering the unit. If the dampers are manually operated, they must be equipped with means to prevent operation of either unit unless the damper is in the full-heat or full-cool position.

HAZARDOUS LOCATIONS



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⚠ WARNING

When furnace is installed in a residential garage, it must be installed so that burners and ignition sources are located a minimum of 18 in. above floor. The furnace must be located or protected to avoid physical damage by vehicles. When furnace is installed in a public garage, airplane hangar, or other building having a hazardous atmosphere, unit must be installed in accordance with requirements of National Fire Protection Association, Inc.

Step 2—Air For Combustion and Ventilation

Provisions for adequate combustion and ventilation air must be provided in accordance with Section 5.3 of the NFGC, Air for Combustion and Ventilation, or applicable provisions of the local building codes.

Canadian installations must be installed in accordance with NSC-NGPIC and all authorities having jurisdiction.

⚠ CAUTION

Air for combustion must not be contaminated by halogen compounds, which include fluoride, chloride, bromide, and iodide. These elements are found in aerosol sprays, detergents, bleaches, cleaning solvents, salts, air fresheners, and other household products.

⚠ CAUTION

The operation of exhaust fans, kitchen ventilation fans, clothes dryers, or fireplaces could create a NEGATIVE PRESSURE CONDITION at the furnace. Make-up air MUST be provided for the ventilation devices, in addition to that required by the furnace.

All fuel-burning equipment must be supplied with air for combustion of the fuel. Sufficient air MUST be provided to ensure there will not be a negative pressure in the equipment room or space. In addition, a positive seal MUST be made between the furnace cabinet and the return-air duct to avoid pulling air from the burner area and blocked vent safeguard opening.

The requirements for combustion and ventilation air depend upon whether the furnace is located in an unconfined or confined space.

UNCONFINED SPACE — An unconfined space must have at least 50 cu ft for each 1000 Btuh of input for all the appliances (such as furnaces, clothes dryer, water heaters, etc.) in the space.

If the unconfined space is of unusually tight construction, air for combustion and ventilation MUST come from either the outdoors or spaces freely communicating with the outdoors. Combustion and ventilation openings must be sized the same as for a confined space as defined below. Return air must not be taken from the room unless an equal or greater amount of air is supplied to the room.

For Example:

58ZAV FURNACE INPUT BTUH	MINIMUM SQ FT WITH 7-1/2 FT CEILING
46,000	307
69,000	460
92,000	613
115,000	767
135,000	920

CONFINED SPACE

A confined space is defined as a space whose volume is less than 50 cu ft per 1000 Btuh of total input ratings of all appliances installed in that space. A confined space MUST have provisions for supplying air for combustion, ventilation, and dilution of flue gases using 1 of the following methods. (See Fig. 3, 4, and Table 2.)

NOTE: In determining free area of an opening, the blocking effect of louvers, grilles, and screens must be considered. If free area of louver or grille design is unknown, assume that wood louvers have a 20 percent free area and metal louvers or grilles have a 60 percent free area. Screens, when used, must not be smaller than 1/4-in. mesh. Louvers and grilles must be constructed so they cannot be closed.

The size of the openings depends upon whether air comes from outside of the structure or an unconfined space inside the structure.

1. All air from inside the structure requires 2 openings (for structures not usually tight):
   a. Each opening MUST have at least 1 sq in. of free area per 1000 Btuh of total input for all equipment within the confined space, but not less than 100 sq in. per opening. (See Fig. 3 and Table 2.) The minimum dimension of air openings shall not be less than 3 in.
   b. If building is constructed unusually tight, a permanent opening directly communicating with the outdoors shall be provided. See item 2 below.
   c. If furnace is installed on a raised platform to provide a return-air plenum, and return air is taken directly from hallway or space adjacent to furnace, all air for combustion must come from outdoors.
2. Air from outside the structure requires 1 of the following methods:
   a. If combustion air is taken from outdoors through 2 vertical ducts, the openings and ducts MUST have at least 1 sq in. of free area per 4000 Btuh of total input for all equipment within the confined space. (See Fig. 4 and Table 2.)
   b. If combustion air is taken from outdoors through 2 horizontal ducts, the openings and ducts MUST have at least 1 sq in. of free area per 2000 Btuh of total input for all equipment within the confined space. (See Fig. 4 and Table 2.)
   c. If combustion air is taken from outdoors through a single opening or duct (horizontal or vertical) commencing within 12 in. of the top of the confined space, opening and duct MUST have at least 1 sq in. of free area per 3000 Btuh of the total input for all equipment within the confined space and not less than the sum of the areas of all vent connectors in the confined space. (See Fig. 4 and Table 2.) Equipment clearances to the structure shall be at least 1 in. from the sides and back and 6 in. from the front of the appliances.

When ducts are used, they must be of the same cross-sectional area as the free area of the openings to which they connect. The minimum dimension of ducts must not be less than 3 in. (See Fig. 4.)

AIR DUCTS

Step 1—General Requirements

The duct system should be designed and sized according to accepted national standards such as those published by: Air Conditioning Contractors Association (ACCA), Sheet Metal and Air Conditioning Contractors National Association (SMACNA) or American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). Or consult factory *The Air Systems Design Guidelines* reference tables available from your local distributor. The duct system should be sized to handle the required system design CFM at the design static pressure.

When a furnace is installed so that the supply ducts carry air to areas outside the space containing the furnace, the return air must also be handled by a duct(s) sealed to the furnace casing and terminating outside the space containing the furnace.

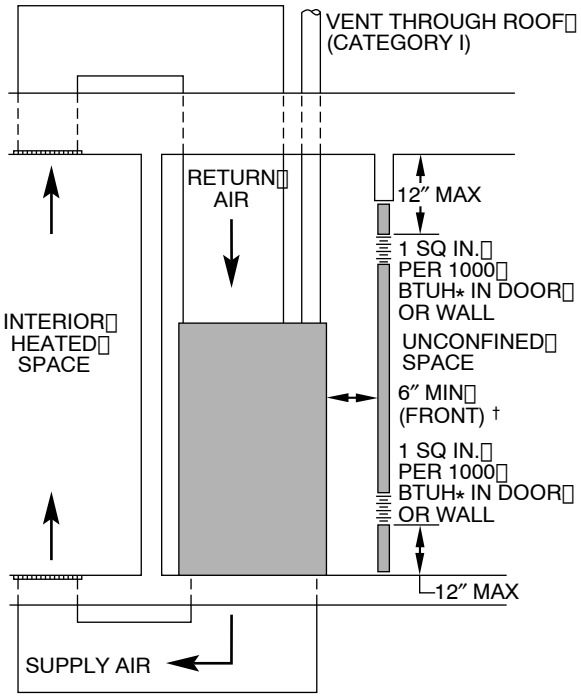
Secure ductwork with proper fasteners for type of ductwork used. Seal supply- and return-duct connections to furnace with code approved tape or duct sealer.

Flexible connections should be used between ductwork and furnace to prevent transmission of vibration. Ductwork passing through unconditioned space should be insulated to enhance system performance. When air conditioning is used, a vapor barrier is recommended.

Maintain a 1-in. clearance from combustible materials to supply air ductwork for a distance of 36 in. horizontally from the furnace. See NFPA 90B or local code for further requirements.

Step 2—Ductwork Acoustical Treatment

Metal duct systems that do not have a 90 degree elbow and 10 ft of main duct to the first branch take-off may require internal acoustical lining. As an alternative, fibrous ductwork may be used if constructed and installed in accordance with the latest edition of SMACNA construction standard on fibrous glass ducts. Both acoustical lining and fibrous ductwork shall comply with NFPA 90B as tested by UL Standard 181 for Class 1 Rigid air ducts.



* Minimum opening size is 100 sq in. with minimum dimensions of 3 in.

† Minimum of 3 in. when type B-1 vent is used.

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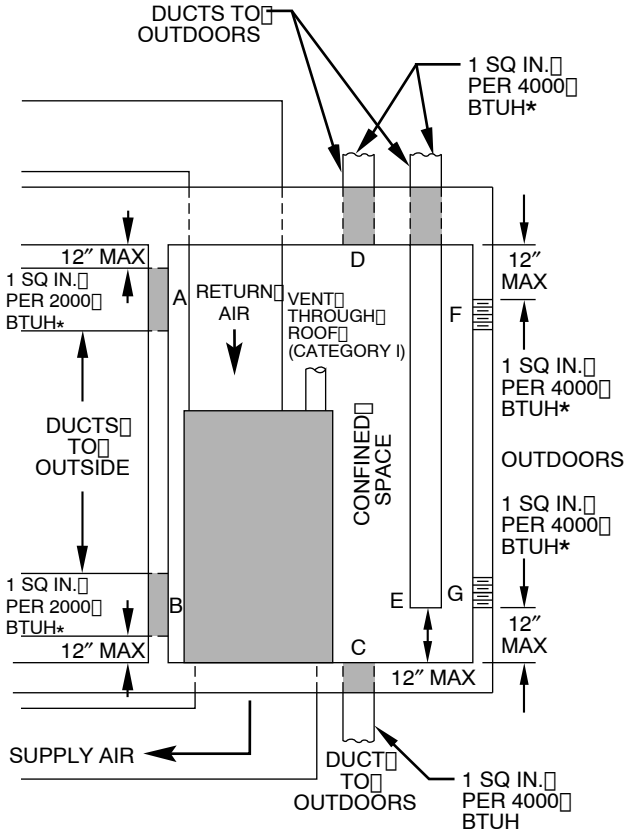
Fig. 3—Confined Space: Air for Combustion and Ventilation from an Unconfined Indoor Space



*Minimum dimensions of 3 in.

NOTE: Use any of the following combinations of openings:
A & B C & D D & E F & G

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Fig. 4—Confined Space: Air for Combustion and Ventilation from Outdoors

Table 2—Minimum Free Area Of Combustion Air Opening

58ZAV FURNACE INPUT (BTUH)	AIR FROM UNCONFINED INDOOR SPACE	OUTDOOR AIR THROUGH VERTICAL DUCTS		OUTDOOR AIR THROUGH HORIZONTAL DUCTS		OUTDOOR AIR THROUGH SINGLE DUCT	
	Free Area of Opening (Sq In.)	Free Area of Opening and Duct (Sq In.)	Round Pipe (In. Dia)	Free Area of Opening and Duct (Sq In.)	Round Pipe (In. Dia)	Free Area of Opening and Duct (Sq In.)	Round Pipe (In. Dia)
46,000	100	11.50	4	23.0	6	15.33	5
69,000	100	17.25	5	34.5	7	23.00	6
92,000	100	23.00	6	46.0	8	30.67	7
115,000	115	28.75	7	57.5	9	38.33	7
135,000	135	33.75	7	67.5	10	45.00	8

* Free area shall be equal to or greater than the sum of the areas of all vent connectors in the confined space. Opening area must be increased if other gas appliances in the space require combustion air.

Step 3—Supply Air Connections

DOWNFLOW FURNACES

Connect supply-air duct to supply-air opening on furnace. The supply-air duct attachment must ONLY be connected to furnace supply/outlet or air conditioning coil casing (when used), when installed on non-combustible material. When installed on combustible material, supply-air duct attachment must ONLY be connected to an accessory subbase or factory approved air conditioning coil casing. DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected external to furnace main casing.

HORIZONTAL FURNACES

Connect supply-air duct to supply air opening on furnace. The supply-air duct attachment must ONLY be connected to furnace supply/outlet or air conditioning coil casing (when used). DO NOT cut main furnace casing to attach supply side air duct, humidifier, or other accessories. All accessories MUST be connected external to furnace main casing.

Step 4—Return Air Connections

The return-air duct must be connected to return-air opening provided as shown in Fig. 1. DO NOT cut into casing sides or back to attach any portion of return-air duct. Bypass humidifier connections should be made at ductwork or coil casing sides exterior to furnace.

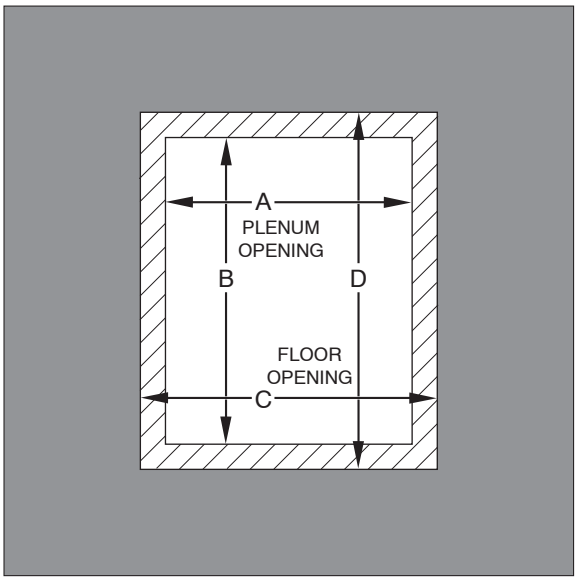

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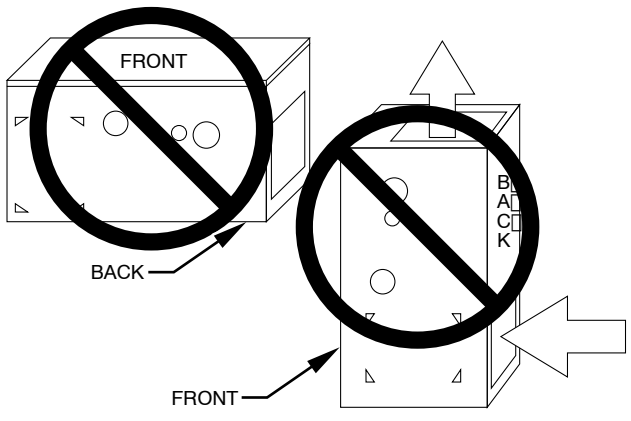
Fig. 5—Floor and Plenum Opening Dimensions

Table 3—Opening Dimensions (In.)

FURNACE CASING WIDTH	APPLICATION	PLENUM OPENING		FLOOR OPENING	
		A	B	C	D
14-3/16	Non-Combustible Flooring	12-11/16	19	13-3/8	19-5/8
	Combustible Flooring Using KGASB Subbase	11-13/16	19	13-7/16	20-3/8
	Combustible Flooring with CD5 or CK5 Coil Assembly or KCAKC Coil Box	12-5/16	19	13-5/16	20
17-1/2	Non-Combustible Flooring	16	19	16-5/8	19-5/8
	Combustible Flooring Using KGASB Subbase	15-1/8	19	16-3/4	20-3/8
	Combustible Flooring with CD5 or CK5 Coil Assembly or KCAKC Coil Box	15-1/2	19	16-1/2	20
21	Non-Combustible Flooring	19-1/2	19	20-1/8	19-5/8
	Combustible Flooring Using KGASB Subbase	18-5/8	19	20-1/4	20-3/8
	Combustible Flooring with CD5 or CK5 Coil Assembly or KCAKC Coil Box	19	19	20	20
24-1/2	Non-Combustible Flooring	23	19	23-5/8	19-5/8
	Combustible Flooring Using KGASB Subbase	22-1/8	19	23-3/4	20-3/8
	Combustible Flooring with CD5 or CK5 Coil Assembly or KCAKC Coil Box	22-1/2	19	23-1/2	20



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⚠ WARNING

Do not install furnace on its back. Safety control operation will be adversely affected. Never connect return-air ducts to back of furnace. Failure to follow this warning could result in fire, personal injury, or death.

Step 5—Downflow Installation

NOTE: This furnace is approved for use on combustible materials or wood flooring. A factory accessory floor base, as listed on the furnace rating plate, MUST be used. A factory accessory floor base is not required when this furnace is installed on manufacturer's Coil Assembly Part No. CD5 or CK5, or Coil Box Part No. KCAKC is used.

1. Determine application being installed from Table 3.
2. Construct hole in floor per dimensions specified in Table 3 and Fig. 5.
3. Construct plenum to dimensions specified in Table 3.
4. If downflow subbase (KGASB) is used, install as shown in Fig. 6.

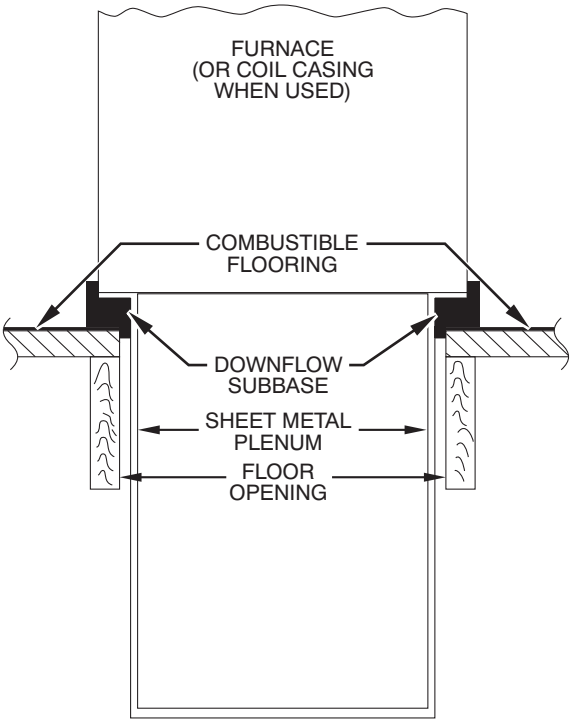

Fig. 6—Furnace, Plenum, and Subbase Installed on a Combustible Floor

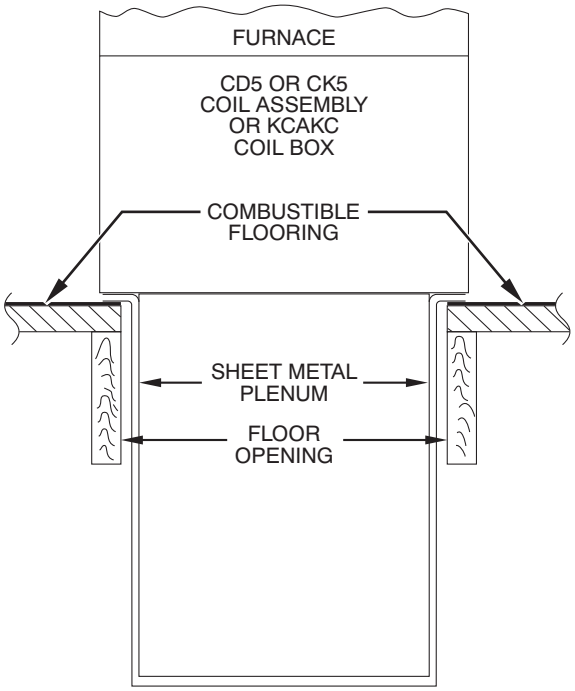

Fig. 7—Furnace, Plenum, and Coil Assembly or Coil Box Installed on a Combustible Floor

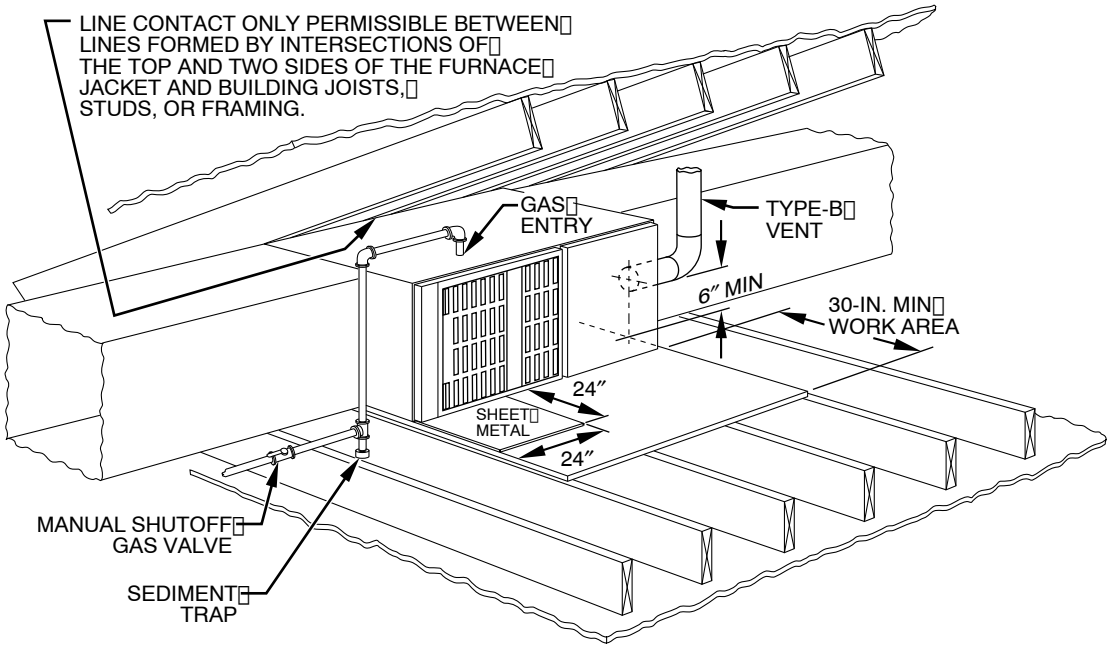

Fig. 8—Typical Attic Installation

If coil assembly CD5, CK5, or Coil Box KCAKC is used, install as shown in Fig. 7.

Step 6—Horizontal Attic Installation

⚠ WARNING

Do not install the furnace on its back; safety control operation will be adversely affected. Never connect return-air ducts to the sides or back of the furnace. Failure to follow this warning could result in fire, personal injury, or death.

The furnace can be installed horizontally on either the left-hand (LH) or right-hand (RH) side. A typical attic installation is shown in Fig. 8.

CONSTRUCT A WORKING PLATFORM

Construct working platform on location where all required furnace clearances are met. (See Fig. 2 and 8.)

INSTALL FURNACE

1. Position furnace in desired location.
2. Connect gas supply pipe. See Fig. 8 for typical piping entry.
3. Install field-supplied filter retainers as indicated in Fig. 11 and Table 4 before connecting return-air duct to furnace.
4. Connect supply- and return-air ducts.
5. Install 24- X 24-in. sheet metal shield on platform in front of louvered control panel as shown in Fig. 8.

Step 7—Horizontal Crawlspace Installation

The furnace can be installed horizontally with either the LH or RH side up. In a crawlspace, furnace can either be hung from floor joist (see Fig. 10) or installed on suitable blocks or pad. (See Fig. 9.) The furnace can be suspended from each corner by hanger bolts (4 each 3/8-in. all-thread rod) cut to desired length, 1- X 3/8-in. flat washer, 3/8-in. lockwasher, and 3/8-in. nut. Dimples are provided for hole locations. (See Fig. 1.)

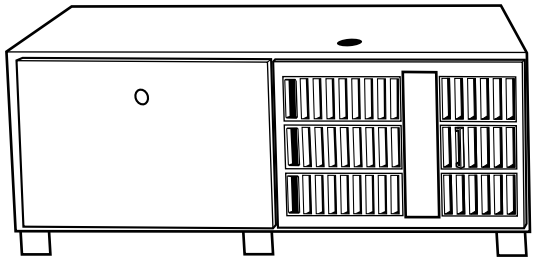

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Fig. 9—Horizontal Installation on Blocks

Since horizontal crawlspace installation is very similar to attic installation, refer to Step 6. The installation of a sheet metal shield in front of louvered control panel is covered in Step 6. For a crawlspace installation, this same sheet metal shield must be installed above louvered control panel. Extend sheet metal shield over furnace top far enough to cover gas pipe entry hole.

Step 8—Filter Arrangement

⚠ WARNING

Never operate unit without a filter or with filter access door removed. Failure to follow this warning could result in fire, personal injury, or death.

The 2 factory-supplied filters are shipped in the blower compartment. After return-air duct has been connected to furnace, install filters in a V-formation inside return-air plenum. See Fig. 11 and Table 4 for horizontal applications. Horizontal filter retainers must be field supplied. See Fig. 12 for downflow applications.

Step 9—Gas Piping

Gas piping must be installed in accordance with national and local codes. Refer to the current edition of the NFGC.

Canadian installations must be installed in accordance with NSC-NGPIC and all authorities having jurisdiction.

Refer to Table 5 for recommended gas pipe sizing. Risers should be used to connect to the furnace and to the meter.

⚠ CAUTION

If a flexible connector is required or allowed by the authority having jurisdiction, black iron pipe shall be installed at the gas valve and extend a minimum of 2 in. outside the furnace casing.

⚠ WARNING

Use the proper length of pipes to avoid stress on the gas control manifold. Failure to follow this warning could result in a gas leak, causing fire, explosion, personal injury, or death.

⚠ CAUTION

Connect the gas pipe to the furnace using a backup wrench to avoid damaging gas controls.

⚠ WARNING

Never purge a line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition to check for gas leakage. Use a soap-and-water solution to check for gas leaks. Failure to follow this warning could result in fire, explosion, personal injury, or death.

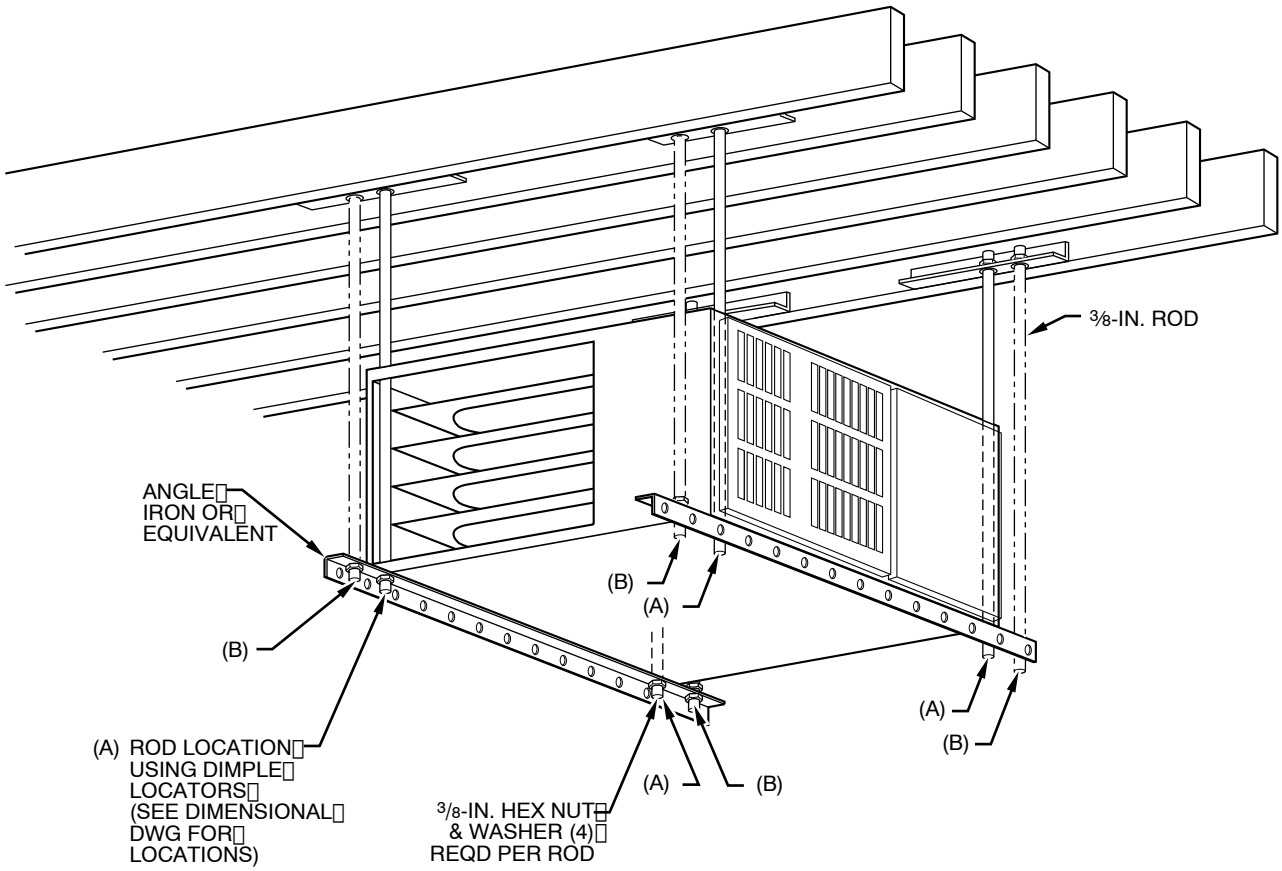
Joint compounds (pipe dope) should be applied sparingly and only to the male threads of the joints. This pipe dope must be resistant to the action of propane gas.

An accessible manual shutoff valve MUST be installed upstream of the furnace gas controls and within 72 in. of the furnace. A 1/8-in. NPT plugged tapping, accessible for test gage connection, MUST be installed immediately upstream of the gas supply connection to the furnace and downstream of the manual shutoff valve. Place a ground joint union between the gas control manifold and the manual shutoff.

Install a sediment trap in the riser leading to the furnace. The trap can be installed by connecting a tee to the riser leading from the furnace. Connect a capped nipple into the lower end of the tee. The capped nipple should extend below the level of the gas controls. (See Fig. 13.)

Piping should be pressure tested in accordance with local and national plumbing and gas codes before the furnace has been attached. If the pressure exceeds 0.5 psig (14-in. wc), the gas supply pipe must be disconnected from the furnace and capped before the pressure test. If the test pressure is equal to or less than 0.5 psig (14-in. wc), turn off electric shutoff switch located on the gas valve before the test. It is recommended that the ground joint union be loosened before pressure testing.

After all connections have been made, purge the lines and check for gas leakage with regulated gas supply pressure.



NOTES: 1. A 1 In. clearance minimum between top of furnace and combustible material.

2. The entire length of furnace must be supported when furnace is used in horizontal position.

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Fig. 10—Horizontal Crawlspace Installation on Hanger Rods

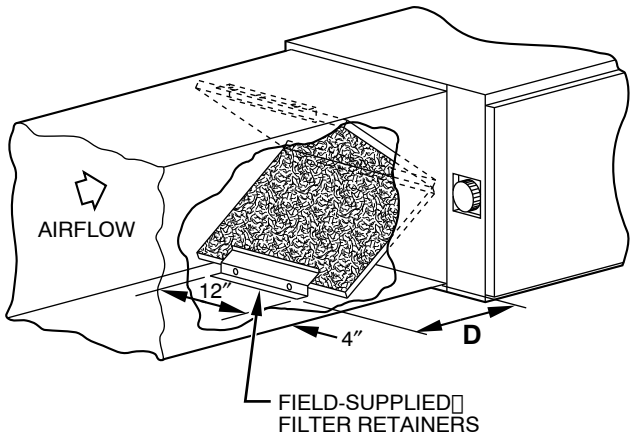

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Fig. 11—Horizontal Filter Arrangement

→Table 4—Filter Retainer (In.)

FURNACE CASING WIDTH	FILTER SIZE AND QUANTITY	D
14-3/16	(2) 16 X 20 X 1	15-3/8
17-1/2	(2) 16 X 20 X 1	14-3/4
21	(2) 16 X 20 X 1	13-3/4
24-1/2	(2) 16 X 20 X 1	12-1/2

Step 10—Electrical Connections

115-V WIRING

Refer to the unit rating plate or Table 6 for equipment electrical requirements. The control system requires an earth ground for proper operation.

⚠ CAUTION

Do not connect aluminum wire between disconnect switch and furnace. Use only copper wire.

Make all electrical connections in accordance with the current edition of the National Electrical Code (NEC) ANSI/NFPA 70-1999, and any local codes or ordinances that might apply. For Canadian installations, all electrical connections must be made in accordance with Canadian Electrical Code CSA C22.1, or authorities having jurisdiction.

NOTE: Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, control status code indicator light will flash rapidly and furnace will not operate.

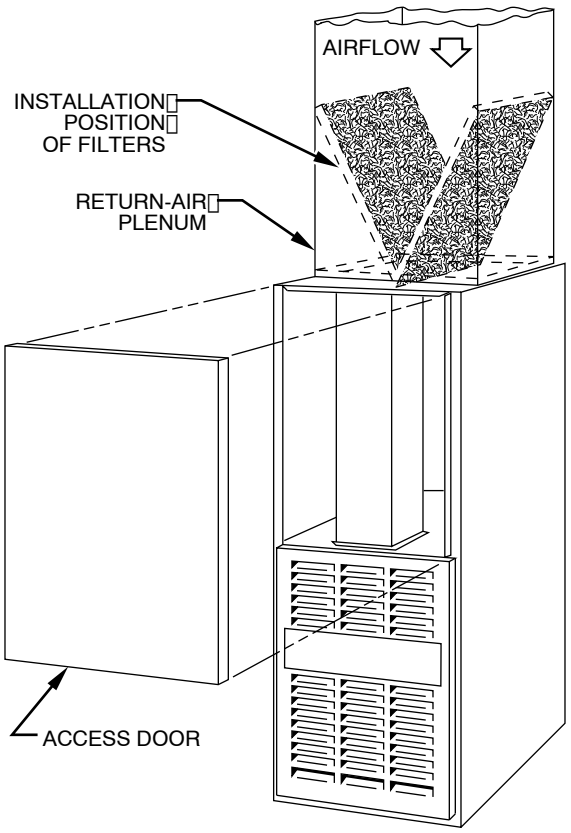

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Fig. 12—Downflow Filter Arrangement

Table 5—Maximum Capacity of Gas Pipe *

NOMINAL IRON PIPE SIZE (IN.)	INTERNAL DIAMETER (IN.)	LENGTH OF PIPE (FT)				
		10	20	30	40	50
1/2	0.622	175	120	97	82	73
3/4	0.824	360	250	200	170	151
1	1.049	680	465	375	320	285
1-1/4	1.380	1400	950	770	660	580
1-1/2	1.610	2100	1460	1180	990	900

* Cubic ft of gas per hr for gas pressures of 0.5 psig (14-in. wc) or less, and a pressure drop of 0.5-in. wc (based on a 0.60 specific gravity gas). Ref: Table 10-2 NFPA 54/ANSI Z223.1-1999.

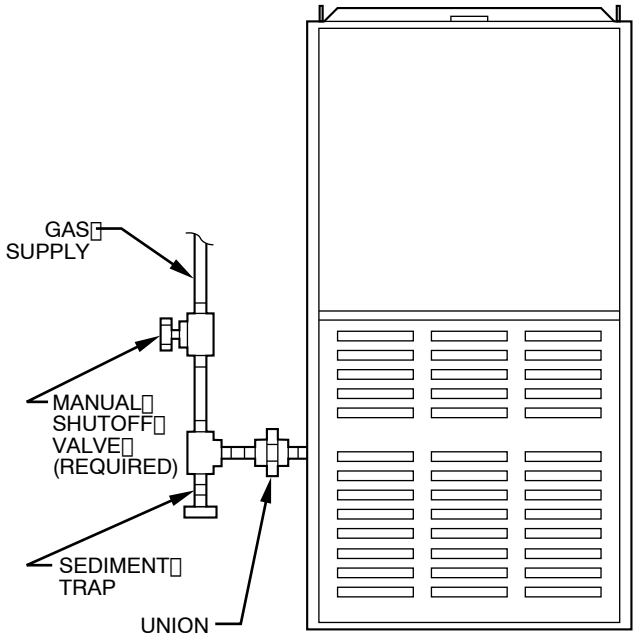

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Fig. 13—Typical Gas Pipe Arrangement

⚠ WARNING

The cabinet MUST have an uninterrupted or unbroken ground according to NEC ANSI/NFPA 70-1999 and Canadian Electrical Code CSA C22.1 or local codes to minimize personal injury if an electrical fault should occur. This may consist of electrical wire or conduit approved for electrical ground when installed in accordance with existing electrical codes. Do not use gas piping as an electrical ground. Failure to follow this warning could result in electrical shock, fire, or death.

24-V WIRING

Make field 24-v connections at the 24-v terminal strip. (See Fig. 14.) Connect terminal Y as shown in Fig. 15 for proper operation in cooling mode. Use AWG No. 18 color-coded wire only.

The 24-v circuit contains an automotive-type, 3-amp fuse located on the main control. Any direct shorts during installation, service, or maintenance could cause this fuse to blow. If fuse replacement is required, use ONLY a 3-amp fuse of identical size.

ACCESSORIES

1. Electronic Air Cleaner (EAC)

Table 6—Electrical Data

UNIT SIZE	VOLTS—HERTZ—PHASE	OPERATING VOLTAGE RANGE		MAXIMUM UNIT AMPS	MINIMUM WIRE GAGE	MAXIMUM WIRE LENGTH FT‡	MAXIMUM FUSE OR CKT BKR AMPS†
		Maximum*	Minimum*				
050-08	115—60—1	127	104	6.6	14	42	15
050-12	115—60—1	127	104	8.1	14	34	15
070-08	115—60—1	127	104	6.7	14	42	15
070-12	115—60—1	127	104	8.4	14	33	15
096-12	115—60—1	127	104	9.2	14	30	15
096-16	115—60—1	127	104	10.2	14	28	15
115-16	115—60—1	127	104	10.1	14	28	15
115-20	115—60—1	127	104	13.3	12	33	20
115-22	115—60—1	127	104	15.2	12	29	20
135-20	115—60—1	127	104	14.3	12	31	20

* Permissible limits of the voltage range at which the unit will operate satisfactorily.
† Time-delay type is recommended.
‡ Length shown is as measured 1 way along wire path between unit and service panel for maximum 2 percent voltage drop.

Two quick-connect terminals marked EAC-1 and EAC-2 are provided for EAC connection. (See Fig. 14.) These terminals are energized with 115-v, (1.5-amp maximum) during blower motor operation.

2. Humidifier (HUM)

   A quick-connect terminal (HUM) and screw terminal (COM) are provided for 24-v humidifier connection. (See Fig. 16.) HUM terminal is energized with 24-v (0.5-amp maximum) after inducer pressure switch closes.

⚠ CAUTION

Do not connect furnace control HUM terminal to HUM (humidifier) terminal on Thermidistat™, Zone Controller, or similar device. See Thermidistat, Zone Controller, thermostat, or controller manufacturer's instructions for proper connection. A failure to follow this warning could result in fire.

NOTE: A field-supplied, 115-v controlled relay connected to EAC terminals may be added if humidifier operation is desired during blower operation.

Step 11—Venting

Refer to the national or local installation code such as NFGC in the United States, or the NSCNGPIC in Canada for proper vent sizing and installation requirements. Use the enclosed Installation Instructions (Single-Stage Vent Tables for Category I Fan-Assisted Furnaces) for a quick, easy reference.

After fully assembling the vent connector to the furnace flue collar, securely fasten the vent connector to the collar with two field-supplied, corrosion-resistant, sheet metal screws located 180° apart and midway up the collar.

The horizontal portion of the venting system shall maintain a minimum of 1/4-in. upward slope per linear ft and it shall be rigidly supported every 5 ft or less with hangers or straps to ensure that there will be no movement after installation.

Step 12—Start-up, Adjustment, and Safety Check

GENERAL

NOTE: Proper polarity must be maintained for 115-v wiring. If polarity is incorrect, control status indicator light will flash rapidly and furnace will not operate.

The furnace must have a 115-v power supply properly connected and grounded. Proper polarity must be maintained for correct operation. Thermostat wire connections at R, W, C, and Y must be made at the furnace 24-v terminal block on the control board. The gas service pressure must not exceed 0.5 psig (14-in. wc), but must be no less than 0.16 psig (4.5-in. wc).

Before operating the furnace, check each manual reset switch for continuity. If necessary, press the button to reset the switch.

The blower compartment door must be in place to complete the 115-v circuit to the furnace.

⚠ CAUTION

This furnace is equipped with 2 manual reset limit switches in the gas control area. The switches will open and shut off power to the gas valve if a flame rollout or an overheating condition occurs in the gas control area. DO NOT bypass the switches. Correct inadequate combustion air supply problem and reset the switches.

SEQUENCE OF OPERATION

⚠ CAUTION

Furnace control must be grounded for proper operation or control will lockout. Control is grounded through green wire routed to gas valve and burner bracket screw.

Using the schematic diagram shown in Fig. 16, follow the sequence of operation through the different modes. Read and follow the wiring diagram very carefully.

NOTE: If there is a power interruption and any thermostat call, the control will initiate a 90-sec blower only on period before starting another cycle.

1. Heating mode

   When the thermostat "calls for heat," R-W circuit closes. The furnace control performs a self-check, verifies the pressure switch contacts are open, and starts the inducer motor.

   a. Prepurge period—As the inducer motor comes up to speed, the pressure switch contacts close to begin a 15-sec prepurge period.

   b. Igniter warm-up—At the end of the prepurge period, the igniter is energized for a 17-sec igniter warm-up period.

   c. Ignition sequence—When the igniter warm-up period is completed, the gas valve opens, permitting gas flow to the burners where it is ignited. After 5 sec, the igniter is de-energized and a 2-sec flame-sensing period begins.

   d. HUM terminal is energized with the gas valve. See Accessories in Electrical Connections section.

   e. Flame-sensing—When burner flame is sensed, the control begins the blower on delay period and continues holding the gas valve open. If burner flame is not sensed, the control closes the gas valve and repeats the ignition cycle.

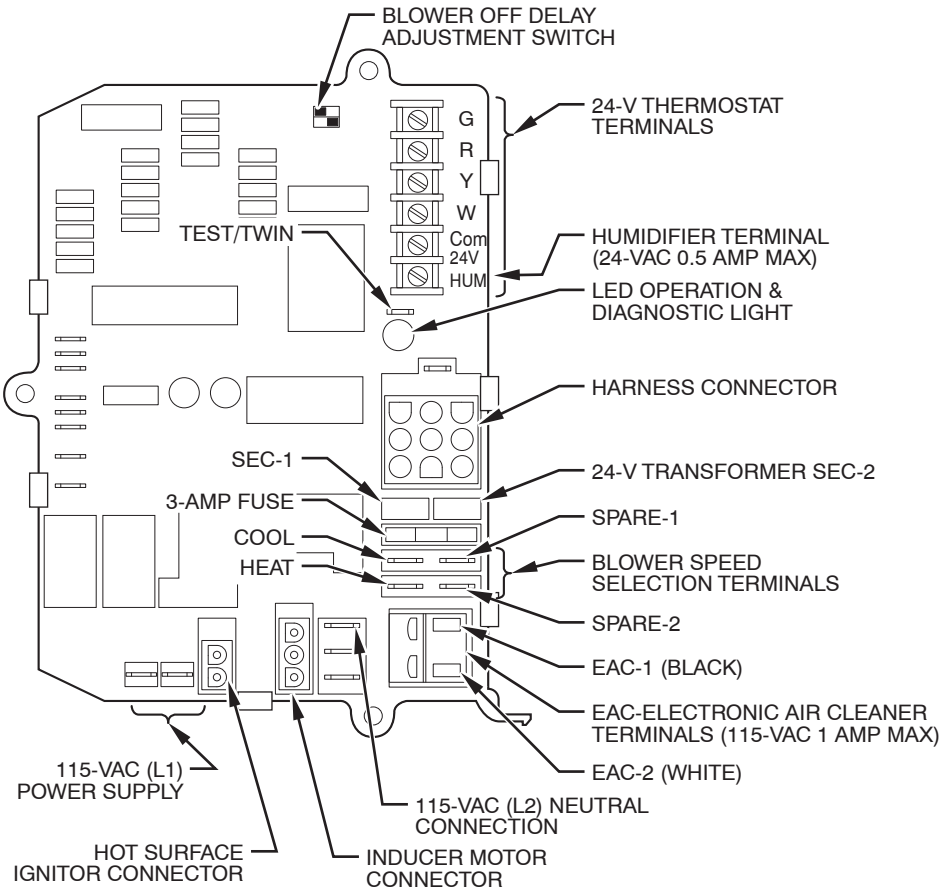
NOTE: Ignition sequence will repeat 3 additional times before a lockout occurs. Lockout automatically resets after 3 hr, or can be manually reset by turning 115v off (not at thermostat) for 3 sec minimum, then on again.

   f. Blower on delay—Forty-five sec after burner flame is proven, the blower motor is energized on heating speed. Simultaneously, terminals HUM and COM-24V for humidifier, and EAC-1 and EAC-2 for EAC are energized. If jumper is on pin 6 and pin 9, the blower on delay period is 66 sec.

   g. Blower off delay—When the thermostat is satisfied, the circuit between R and W is broken, de-energizing the gas valve and stopping gas flow to the burners. The blower motor, and EAC remain energized 90, 135, 180, or 225 sec (depending on the blower off time selection). The furnace is factory set for a 135-sec blower off delay period.

   h. Post-purge—The inducer motor remains energized 5 sec after the burners are extinguished. If jumper is on pin 6 and pin 9, the post-purge period is 15 sec.

2. Cooling mode



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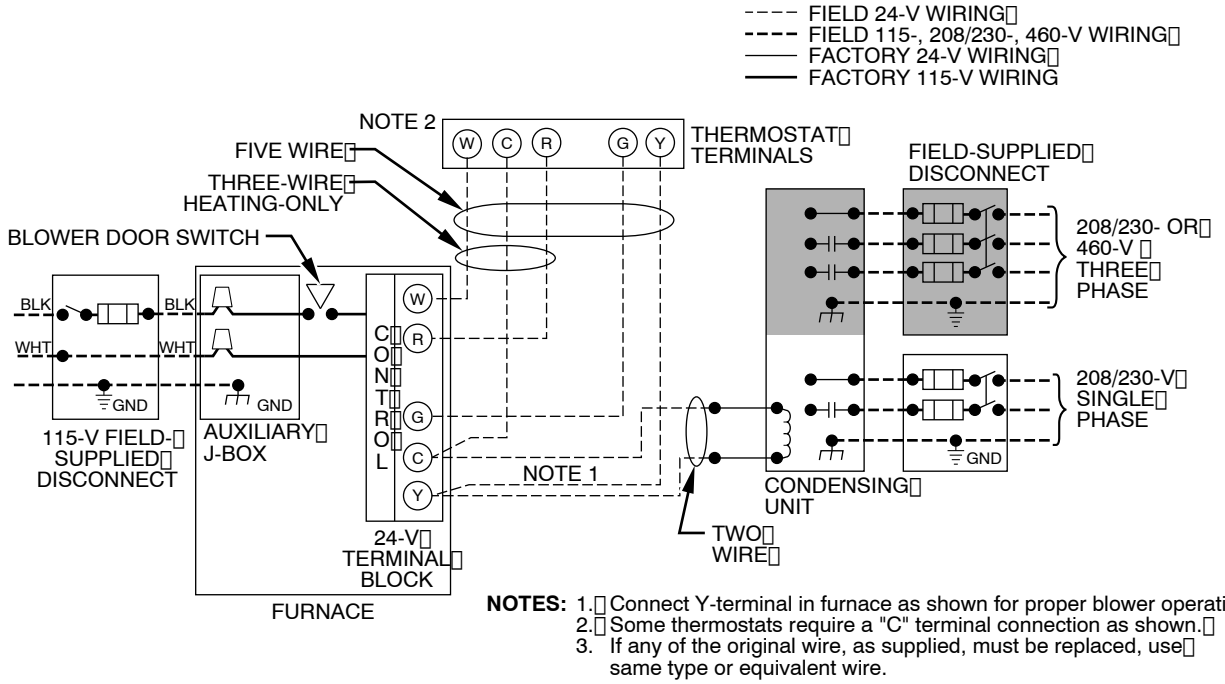
→**Fig. 14—Furnace Control**



NOTES: 1. Connect Y-terminal in furnace as shown for proper blower operation.
2. Some thermostats require a "C" terminal connection as shown.
3. If any of the original wire, as supplied, must be replaced, use same type or equivalent wire.

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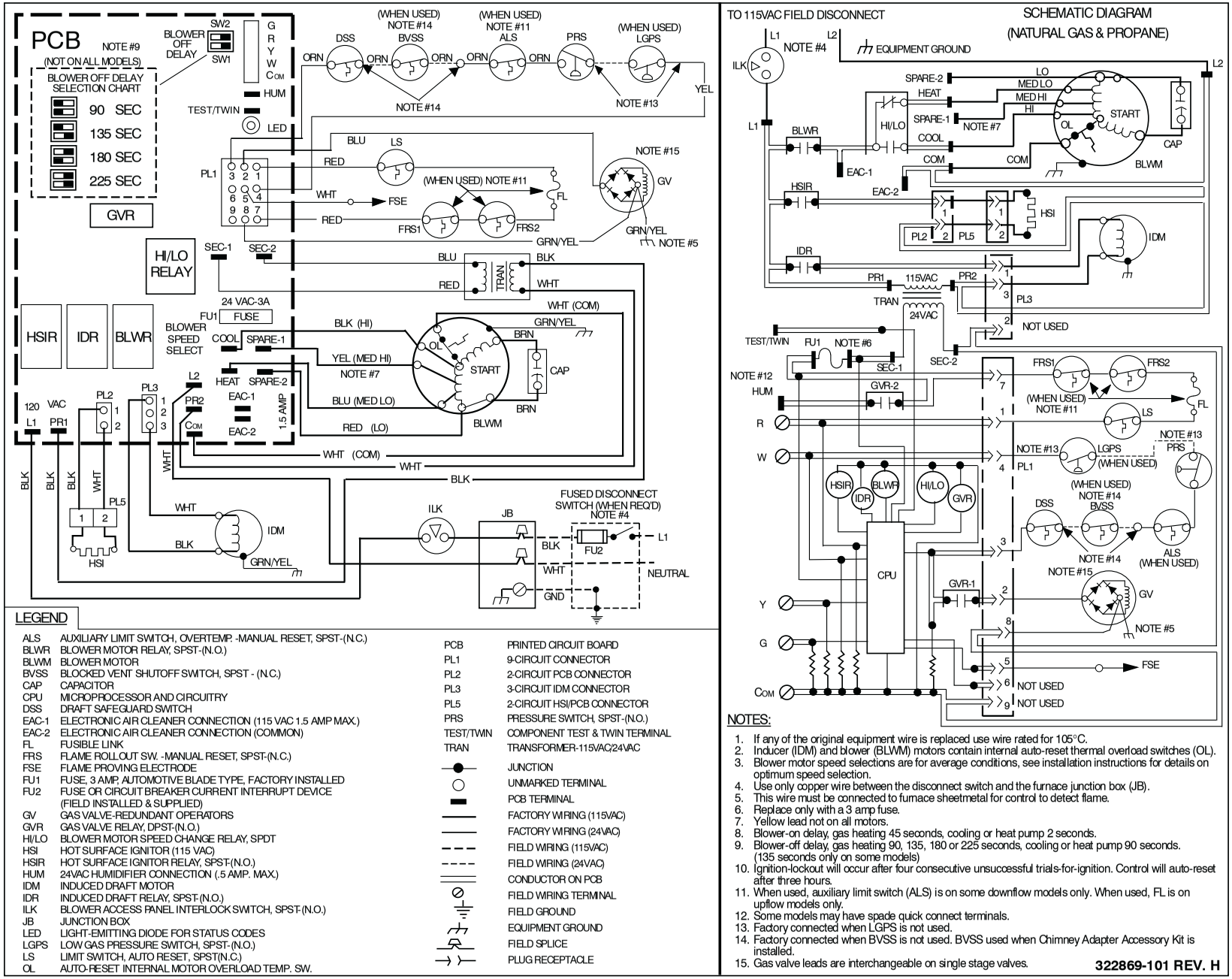
Fig. 15—Heating and Cooling Application Wiring Diagram



NOTES:

1. If any of the original equipment wire is replaced use wire rated for 105°C.
2. Inducer (IDM) and blower (BLWM) motors contain internal auto-reset thermal overload switches (OL).
3. Blower motor speed selections are for average conditions, see installation instructions for details on optimum speed selection.
4. Use only copper wire between the disconnect switch and the furnace junction box (JB).
5. This wire must be connected to furnace sheetmetal for control to detect flame.
6. Replace only with a 3 amp fuse.
7. Yellow lead not on all motors.
8. Blower-on delay, gas heating 45 seconds, cooling or heat pump 2 seconds.
9. Blower-off delay, gas heating 90, 135, 180 or 225 seconds, cooling or heat pump 90 seconds. (135 seconds only on some models)
10. Ignition-lockout will occur after four consecutive unsuccessful trials-for-ignition. Control will auto-reset after three hours.
11. When used, auxiliary limit switch (ALS) is on some downflow models only. When used, FL is on upflow models only.
12. Some models may have spade quick connect terminals.
13. Factory connected when LGPS is not used.
14. Factory connected when BVSS is not used. BVSS used when Chimney Adapter Accessory Kit is installed.
15. Gas valve leads are interchangeable on single stage valves.

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LEGEND

ALS	AUXILIARY LIMIT SWITCH, OVERTEMP. -MANUAL RESET, SPST-(N.C.)
BLWR	BLOWER MOTOR RELAY, SPST-(N.O.)
BLWM	BLOWER MOTOR
BVSS	BLOCKED VENT SHUTOFF SWITCH, SPST - (N.C.)
CAP	CAPACITOR
CPU	MICROPROCESSOR AND CIRCUITRY
DSS	DRAFT SAFEGUARD SWITCH
EAC-1	ELECTRONIC AIR CLEANER CONNECTION (115 VAC 1.5 AMP MAX.)
EAC-2	ELECTRONIC AIR CLEANER CONNECTION (COMMON)
FL	FUSIBLE LINK
FRS	FLAME ROLLOUT SW. -MANUAL RESET, SPST-(N.C.)
FSE	FLAME PROVING ELECTRODE
FU1	FUSE, 3 AMP, AUTOMOTIVE BLADE TYPE, FACTORY INSTALLED
FU2	FUSE OR CIRCUIT BREAKER CURRENT INTERRUPT DEVICE (FIELD INSTALLED & SUPPLIED)
GV	GAS VALVE-REDUNDANT OPERATORS
GVR	GAS VALVE RELAY, DPST-(N.O.)
HI/LO	BLOWER MOTOR SPEED CHANGE RELAY, SPDT
HSI	HOT SURFACE IGNITOR (115 VAC)
HSIR	HOT SURFACE IGNITOR RELAY, SPST-(N.O.)
HUM	24VAC HUMIDIFIER CONNECTION (.5 AMP. MAX.)
IDM	INDUCED DRAFT MOTOR
IDR	INDUCED DRAFT RELAY, SPST-(N.O.)
ILK	BLOWER ACCESS PANEL INTERLOCK SWITCH, SPST-(N.O.)
JB	JUNCTION BOX
LED	LIGHT-EMITTING DIODE FOR STATUS CODES
LGPS	LOW GAS PRESSURE SWITCH, SPST-(N.O.)
LS	LIMIT SWITCH, AUTO RESET, SPST(N.C.)
OL	AUTO-RESET INTERNAL MOTOR OVERLOAD TEMP. SW.
PCB	PRINTED CIRCUIT BOARD
PL1	9-CIRCUIT CONNECTOR
PL2	2-CIRCUIT PCB CONNECTOR
PL3	3-CIRCUIT IDM CONNECTOR
PL5	2-CIRCUIT HSI/PCB CONNECTOR
PRS	PRESSURE SWITCH, SPST-(N.O.)
TEST/TWIN	COMPONENT TEST & TWIN TERMINAL
TRAN	TRANSFORMER-115VAC/24VAC
	JUNCTION
	UNMARKED TERMINAL
	PCB TERMINAL
	FACTORY WIRING (115VAC)
	FACTORY WIRING (24VAC)
	FIELD WIRING (115VAC)
	FIELD WIRING (24VAC)
	CONDUCTOR ON PCB
	FIELD WIRING TERMINAL
	FIELD GROUND
	EQUIPMENT GROUND
	FIELD SPLICE
	PLUG RECEPTACLE

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→Fig. 16—Furnace Wiring Diagram

When the thermostat "calls for cooling," R-G and R-Y circuits close. The R-Y circuit starts the outdoor condensing unit and combined R-Y and R-G circuits start the furnace blower motor on cooling speed. The EAC-1 terminal is energized with 115v whenever the blower is operating on cooling speed.

When the thermostat is satisfied, R-G and R-Y circuits are broken. Furnace blower and EAC continue operating on cooling speed for an additional 90 sec.

3. Continuous blower mode

NOTE: EAC-1 terminal is energized with 115v whenever blower is operating.

When the R-G circuit is made, the blower motor operates on heating speed. During a call for heat, the blower stops, allowing the furnace heat exchangers to heat up more quickly, then restarts at the end of the 45-sec blower on delay period. If jumper is on pin 6 and pin 9, the blower on delay period is 66 sec.

The blower reverts to continuous operation after the heating cycle is completed.

When the thermostat "calls for cooling," the blower operates on cooling speed. When the thermostat is satisfied, the blower operates an additional 90 sec before reverting back to continuous operation on heating speed.

4. Heat pump mode

When installed with a heat pump, the furnace control automatically changes the timing sequence to avoid long blower off time during demand defrost cycles. When the W-Y or W-Y-G thermostat inputs are received at the same time, the control changes the blower to heating speed or starts the blower if it was off, and begins a heating cycle. The blower remains on until the end of the prepurge period, then shuts off until the end of the ignition warm up and trial for ignition periods (a total of 24 sec). The blower then comes back on at heating speed.

When the W input signal disappears, the control begins the normal inducer post-purge period and the blower changes to cooling speed after a 1-sec delay. If the W-Y-G signals disappear at the same time, the blower remains on for the selected heating blower off delay period and the inducer goes through its normal post-purge period. If the W-Y inputs should disappear, leaving the G signal input, the control goes into continuous blower and the inducer remains on for the normal post-purge period.

Anytime the control senses false flame, the control locks out of the heating mode. This occurs because the control cannot sense the W input due to the false flame signal and, as a result, sees only the Y input and goes into cooling mode blower off delay. All other control functions remain in standard format.

NOTE: EAC-1 terminal is energized whenever blower operates. HUM terminal is only energized when gas valve is energized.

START-UP PROCEDURES

1. Purge gas lines—After all connections have been made, purge the lines and check for leaks.

⚠ WARNING

Never purge a line into a combustion chamber. Never use matches, candles, flame, or other sources of ignition to check for gas leakage. Use a soap-and-water solution to check for gas leaks. Failure to follow this warning could result in fire, explosion, personal injury, or death.

2. Component test—The furnace control allows all components, except gas valve, to be run for a short period of time.

This feature helps diagnose a system problem in case of a component failure. To initiate component test procedure, short (jumper) the TEST 3/16-in. quick connect terminal on control (adjacent to diagnostic light) and the COM-24V terminal on furnace thermostat connection block for approximately 2 sec. (See Fig. 14.)

NOTE: Component test feature will not operate if any thermostat signal is present at control.

Component test sequence is as follows.

a. Momentarily jumper TEST and COM-24V terminals until LED goes off.

b. LED will display previous status 4 times.

c. Inducer motor starts and continues to run for entire component test.

d. Hot surface igniter is energized for 15 sec, then de-energized.

e. Blower motor operates on cooling speed for 10 sec, then stops.

f. Blower motor operates on heating speed for 10 sec, then stops.

g. Inducer motor stops.

3. To operate furnace, follow procedures on operating instruction label attached to furnace.

4. With furnace operating, set thermostat below room temperature and observe that furnace goes off. Set thermostat above room temperature and observe that furnace restarts.

ADJUSTMENTS

1. Set gas input rate
Furnace gas input rate on rating plate is for installations at altitudes up to 2000 ft. Furnace input rate must be within ±2 percent of input on furnace rating plate.

a. Determine natural gas orifice size and manifold pressure for correct input.

(1.) Obtain average yearly gas heat value (at installed altitude) from local gas supplier.

(2.) Obtain average yearly gas specific gravity from local gas supplier.

(3.) Verify furnace model. Table 7 can only be used for model 58ZAV Furnaces.

(4.) Find installation altitude in Table 7.

NOTE: For Canada altitudes of 2000 to 4500 ft, use U.S.A. altitudes of 2001 to 3000 ft in Table 7.

(5.) Find closest natural gas heat value and specific gravity in Table 7.

(6.) Follow heat value and specific gravity lines to point of intersection to find orifice size and manifold pressure settings for proper operation .

EXAMPLE: (0—2000 ft altitude)
Heating value = 1050 Btu/cu ft
Specific gravity = 0.62
Therefore: Orifice No. 43*
Manifold pressure 3.6-in. wc
* Furnace is shipped with No. 43 orifices. In this example all main burner orifices are the correct size and do not need to be changed to obtain proper input rate.

(7.) Check and verify burner orifice size in furnace. NEVER ASSUME ORIFICE SIZE. ALWAYS CHECK AND VERIFY.

→Table 7—Model 58ZAV Orifice Size† and Manifold Pressure for Correct Input (Tabulated Data Based on 23,000 BTUH Per Burner, Derated 4 Percent per 1000 Ft Above Sea Level)*

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. and Canada		**850**	41	3.6	41	3.7	41	3.8	40	3.6	40	3.8
		875	42	3.8	41	3.5	41	3.6	41	3.7	41	3.8
		900	42	3.5	42	3.7	42	3.8	41	3.5	41	3.6
	0	**925**	42	3.4	42	3.5	42	3.6	42	3.7	42	3.8
		950	42	3.2	42	3.3	42	3.4	42	3.5	42	3.6
	to	**975**	**43**	**3.7**	**43**	**3.8**	42	3.2	42	3.3	42	3.4
		1000	**43**	**3.5**	**43**	**3.6**	**43**	**3.7**	42	3.2	42	3.3
	2000	**1025**	**43**	**3.3**	**43**	**3.4**	**43**	**3.6**	**43**	**3.7**	**43**	**3.8**
		1050	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**	**43**	**3.6**
		1075	44	3.5	44	3.6	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**
		1100	44	3.3	44	3.4	44	3.5	**43**	**3.2**	**43**	**3.3**

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. and Canada	**U.S.A**	**775**	42	3.7	42	3.8	41	3.5	41	3.6	41	3.8
	Altitudes	**800**	42	3.4	42	3.6	42	3.7	42	3.8	41	3.5
	2001	**825**	42	3.2	42	3.3	42	3.5	42	3.6	42	3.7
	to	**850**	**43**	**3.7**	**43**	**3.8**	42	3.3	42	3.4	42	3.5
	3000	**875**	**43**	**3.5**	**43**	**3.6**	**43**	**3.7**	42	3.2	42	3.3
	or	**900**	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**	**43**	**3.7**	**43**	**3.8**
	Canada	**925**	**43**	**3.1**	**43**	**3.2**	**43**	**3.4**	**43**	**3.5**	**43**	**3.6**
	Altitudes	**950**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**
	2000	**975**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**
	to	**1000**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**
	4500	**1025**	**43**	**2.6**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only		**750**	42	3.4	42	3.6	42	3.7	42	3.8	41	3.5
		775	42	3.2	42	3.3	42	3.5	42	3.6	42	3.7
		800	**43**	**3.7**	**43**	**3.8**	42	3.2	42	3.3	42	3.4
	3001	**825**	**43**	**3.5**	**43**	**3.6**	**43**	**3.7**	**43**	**3.8**	42	3.2
		850	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**	**43**	**3.6**	**43**	**3.7**
	to	**875**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**
		900	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**
	4000	**925**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.0**	**43**	**3.1**
		950	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**
		975	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**	**43**	**2.7**	**43**	**2.8**
		1000	**43**	**2.4**	**43**	**2.4**	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only		**725**	42	3.2	42	3.3	42	3.5	42	3.6	42	3.7
		750	**43**	**3.7**	**43**	**3.8**	42	3.2	42	3.3	42	3.4
		775	**43**	**3.4**	**43**	**3.6**	**43**	**3.7**	**43**	**3.8**	42	3.2
	4001	**800**	**43**	**3.2**	**43**	**3.3**	**43**	**3.5**	**43**	**3.6**	**43**	**3.7**
		825	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.4**	**43**	**3.5**
	to	**850**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**
		875	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**
	5000	**900**	**43**	**2.6**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**
		925	**43**	**2.4**	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**
		950	**43**	**2.3**	**43**	**2.4**	**43**	**2.5**	**43**	**2.5**	**43**	**2.6**

* For size 135-20 only, input is 22,500 Btuh per burner. Deduct 0.1-in. wc from manifold pressure shown in table. Change orifice size if manifold pressure falls below 3.2-in. wc on altitudes up to 2000 ft, otherwise change orifice size if manifold pressure falls below 2.0-in. wc.
† Orifices sizes shown in **BOLD** are factory installed.

→Table 7—Model 58ZAV Orifice Size† and Manifold Pressure for Correct Input (Continued)
(Tabulated Data Based on 23,000 BTUH Per Burner, Derated 4 percent per 1000 Ft Above Sea Level)*

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only		**700**	**43**	**3.7**	**43**	**3.8**	42	3.2	42	3.3	42	3.4
		725	**43**	**3.4**	**43**	**3.6**	**43**	**3.7**	**43**	**3.8**	42	3.2
		750	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**	**43**	**3.6**
		775	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**
	5001	**800**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**
		825	**43**	**2.7**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**
	to	**850**	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.8**
		875	**43**	**2.4**	**43**	**2.4**	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**
	6000	**900**	**43**	**2.2**	**43**	**2.3**	**43**	**2.4**	**43**	**2.5**	**43**	**2.5**
		925	**43**	**2.1**	**43**	**2.2**	**43**	**2.3**	**43**	**2.3**	**43**	**2.4**
		950	48	3.8	**43**	**2.1**	**43**	**2.1**	**43**	**2.2**	**43**	**2.3**
		975	48	3.6	48	3.7	**43**	**2.0**	**43**	**2.1**	**43**	**2.2**
		1000	48	3.4	48	3.5	48	3.6	48	3.7	**43**	**2.1**

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only		**650**	**43**	**3.7**	**43**	**3.8**	42	3.2	42	3.3	42	3.5
		675	**43**	**3.4**	**43**	**3.5**	**43**	**3.7**	**43**	**3.8**	42	3.2
		700	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**	**43**	**3.6**
	6001	**725**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**
		750	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**
	to	**775**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**
		800	**43**	**2.4**	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**
	7000	**825**	**43**	**2.3**	**43**	**2.4**	**43**	**2.5**	**43**	**2.5**	**43**	**2.6**
		850	**43**	**2.2**	**43**	**2.2**	**43**	**2.3**	**43**	**2.4**	**43**	**2.5**
		875	**43**	**2.0**	**43**	**2.1**	**43**	**2.2**	**43**	**2.3**	**43**	**2.3**

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only		**625**	**43**	**3.4**	**43**	**3.6**	**43**	**3.7**	**43**	**3.8**	42	3.2
		650	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**	**43**	**3.6**
		675	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**
	7001	**700**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**
		725	**43**	**2.6**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**
	to	**750**	**43**	**2.4**	**43**	**2.5**	**43**	**2.6**	**43**	**2.6**	**43**	**2.7**
		775	**43**	**2.2**	**43**	**2.3**	**43**	**2.4**	**43**	**2.5**	**43**	**2.5**
	8000	**800**	**43**	**2.1**	**43**	**2.2**	**43**	**2.2**	**43**	**2.3**	**43**	**2.4**
		825	48	3.7	**43**	**2.0**	**43**	**2.1**	**43**	**2.2**	**43**	**2.2**
		850	48	3.5	48	3.6	48	3.7	**43**	**2.1**	**43**	**2.1**

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only		**600**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**	**43**	**3.5**	**43**	**3.6**
		625	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**
	8001	**650**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**
		675	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**
	to	**700**	**43**	**2.4**	**43**	**2.4**	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**
		725	**43**	**2.2**	**43**	**2.3**	**43**	**2.3**	**43**	**2.4**	**43**	**2.5**
	9000	**750**	**43**	**2.0**	**43**	**2.1**	**43**	**2.2**	**43**	**2.3**	**43**	**2.3**
		775	48	3.6	48	3.7	**43**	**2.1**	**43**	**2.1**	**43**	**2.2**
		800	48	3.4	48	3.5	48	3.6	48	3.7	**43**	**2.0**

* For size 135-20 only, input is 22,500 Btuh per burner. Deduct 0.1-in. wc from manifold pressure shown in table. Change orifice size if manifold pressure falls below 3.2-in. wc on altitudes up to 2000 ft, otherwise change orifice size if manifold pressure falls below 2.0-in. wc.
† Orifice sizes shown in **BOLD** are factory installed.

→Table 7—Model 58ZAV Orifice Size† and Manifold Pressure for Correct Input (Continued)
(Tabulated Data Based on 23,000 BTUH Per Burner, Derated 4 percent per 1000 Ft Above Sea Level)*

ALTITUDE RANGE (FT)		AVG GAS HEAT VALUE AT ALTITUDE (BTU/CU FT)	SPECIFIC GRAVITY OF NATURAL GAS									
			0.58		0.60		0.62		0.64		0.66	
			Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure	Orifice No.	Manifold Pressure
U.S.A. Only		**575**	**43**	**3.0**	**43**	**3.1**	**43**	**3.2**	**43**	**3.3**	**43**	**3.4**
		600	**43**	**2.7**	**43**	**2.8**	**43**	**2.9**	**43**	**3.0**	**43**	**3.1**
	9001	**625**	**43**	**2.5**	**43**	**2.6**	**43**	**2.7**	**43**	**2.8**	**43**	**2.8**
		650	**43**	**2.3**	**43**	**2.4**	**43**	**2.5**	**43**	**2.6**	**43**	**2.6**
	to	**675**	**43**	**2.1**	**43**	**2.2**	**43**	**2.3**	**43**	**2.4**	**43**	**2.4**
		700	48	3.8	**43**	**2.1**	**43**	**2.1**	**43**	**2.2**	**43**	**2.3**
	10,000	**725**	48	3.5	48	3.6	48	3.7	**43**	**2.1**	**43**	**2.1**
		750	49	3.8	48	3.4	48	3.5	48	3.6	48	3.7
		775	49	3.6	49	3.7	49	3.8	48	3.4	48	3.5

* For size 135-20 only, input is 22,500 Btuh per burner. Deduct 0.1-in. wc from manifold pressure shown in table. Change orifice size if manifold pressure falls below 3.2-in. wc on altitudes up to 2000 ft, otherwise change orifice size if manifold pressure falls below 2.0-in. wc.

† Orifice sizes shown in **BOLD** are factory installed.

b. Adjust manifold pressure to obtain input rate.

(1.) Remove regulator adjustment seal cap. (See Fig. 18.)

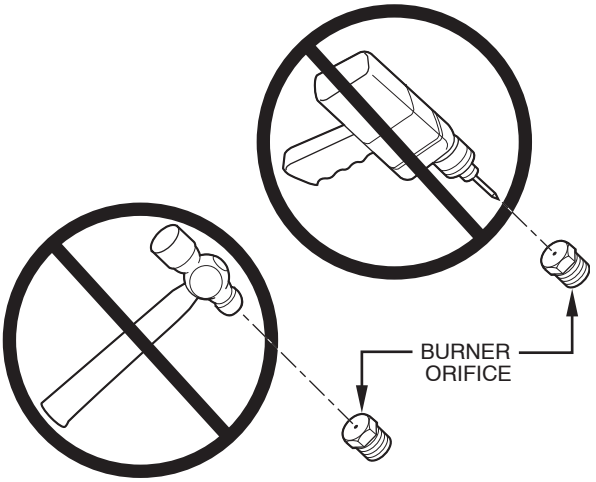
(2.) Turn adjusting screw, counterclockwise (out) to decrease manifold pressure or clockwise (in) to increase manifold pressure.

NOTE: This furnace has been approved for a manifold pressure of 3.2-in. wc to 3.8-in. wc when installed at altitudes up to 2000 ft. For altitudes above 2000 ft, the manifold pressure can be adjusted from 2.0-in. wc to 3.8-in. wc.

⚠ CAUTION

DO NOT bottom out gas valve regulator adjusting screw. This can result in unregulated manifold pressure and result in excess overfire and heat exchanger failures.

NOTE: If orifice hole appears damaged or it is suspected to have been redrilled, check orifice hole with a numbered drill bit of correct size. Never redrill an orifice. A burr-free and squarely aligned orifice hole is essential for proper flame characteristics.



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⚠ CAUTION

DO NOT redrill orifices. Improper drilling (burrs, out-of-round holes, etc.) can cause excessive burner noise and misdirection of burner flames. This can result in flame impingement of burners and heat exchangers, causing failures..

(3.) After correct manifold pressure is obtained, replace gas valve regulator adjustment screw cap and verify adjusted gas input rate using method outlined in item c.

(4.) Burner flame should be clear blue, almost transparent. (See Fig. 19.)

c. Verify natural gas input rate by clocking gas meter.

NOTE: High-Altitude Adjustment

United States

At installation altitudes above 2000 ft, this furnace has been approved for a 4 percent derate for each 1000 ft above sea level. See Table 8 for derate multiplier factor.

Table 8—Altitude Derate Multiplier for U.S.A.

ALTITUDE (FT)	% OF DERATE	DERATE MULTIPLIER FACTOR FOR U.S.A*
0—2000	0	1.00
2001—3000	8—12	0.90
3001—4000	12—16	0.86
4001—5000	16—20	0.82
5001—6000	20—24	0.78
6001—7000	24—28	0.74
7001—8000	28—32	0.70
8001—9000	32—36	0.66
9001—10,000	36—40	0.62

* Derate multiplier factor is based on midpoint altitude for altitude range.

EXAMPLE:

92,000 Btuh input furnace installed at 4300 ft.

Furnace Input Rate at Sea Level	X	Derate Multiplier Factor	=	Furnace Input Rate at Installation Altitude
92,000		0.82		75,440

Canada

At installation altitudes from 2000 to 4500 ft, this furnace must be derated 10 percent by an authorized Gas Conversion Station. To determine correct input rate for altitude, see example above and use 0.90 as derate multiplier factor.

a. Turn off all other gas appliances and pilots.

b. Start furnace and let operate for 3 minutes.

c. Measure time (in sec) for gas meter test dial to complete 1 revolution.

Table 9—Gas Rate (Cu Ft/Hr)

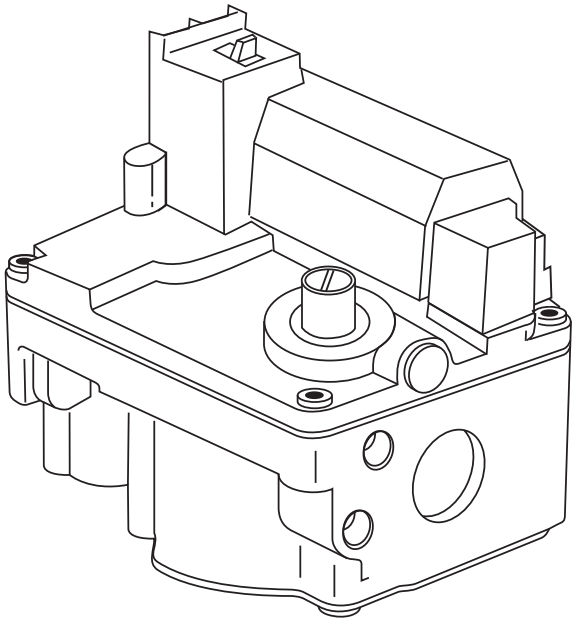
SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL			SECONDS FOR 1 REVOLUTION	SIZE OF TEST DIAL		
	1 cu ft	2 cu ft	5 cu ft		1 cu ft	2 cu ft	5 cu ft
10	360	720	1800	**50**	72	144	360
11	327	655	1636	**51**	71	141	355
12	300	600	1500	**52**	69	138	346
13	277	555	1385	**53**	68	136	340
14	257	514	1286	**54**	67	133	333
15	240	480	1200	**55**	65	131	327
16	225	450	1125	**56**	64	129	321
17	212	424	1059	**57**	63	126	316
18	200	400	1000	**58**	62	124	310
19	189	379	947	**59**	61	122	305
20	180	360	900	**60**	60	120	300
21	171	343	857	**62**	58	116	290
22	164	327	818	**64**	56	112	281
23	157	313	783	**66**	54	109	273
24	150	300	750	**68**	53	106	265
25	144	288	720	**70**	51	103	257
26	138	277	692	**72**	50	100	250
27	133	267	667	**74**	48	97	243
28	129	257	643	**76**	47	95	237
29	124	248	621	**78**	46	92	231
30	120	240	600	**80**	45	90	225
31	116	232	581	**82**	44	88	220
32	113	225	563	**84**	43	86	214
33	109	218	545	**86**	42	84	209
34	106	212	529	**88**	41	82	205
35	103	206	514	**90**	40	80	200
36	100	200	500	**92**	39	78	196
37	97	195	486	**94**	38	76	192
38	95	189	474	**96**	38	75	188
39	92	185	462	**98**	37	74	184
40	90	180	450	**100**	36	72	180
41	88	176	439	**102**	35	71	178
42	86	172	429	**104**	35	69	173
43	84	167	419	**106**	34	68	170
44	82	164	409	**108**	33	67	167
45	80	160	400	**110**	33	65	164
46	78	157	391	**112**	32	64	161
47	76	153	383	**116**	31	62	155
48	75	150	375	**120**	30	60	150
49	73	147	367				

d. Refer to Table 9 for cu ft of gas per hr.

e. Multiply gas rate (cu ft/hr) X heating value (Btu/cu ft) using natural gas heating value from local gas utility/supplier.

EXAMPLE: (0—2000 ft altitude)
Btu heating input = Btu/cu ft X cu ft/hr
Heating value of gas = 1050 Btu/cu ft
Time for 1 revolution of 2-cu ft dial = 82 sec
Gas rate = 88 cu ft/hr (from Table 9)
Btu heating input = 88 X 1050 = 92,400 Btuh
In this example, the orifice size and manifold pressure adjustment is within ±2 percent of the furnace input rate.

2. Set temperature rise.



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→**Fig. 17—Redundant Automatic Gas Control Valve**

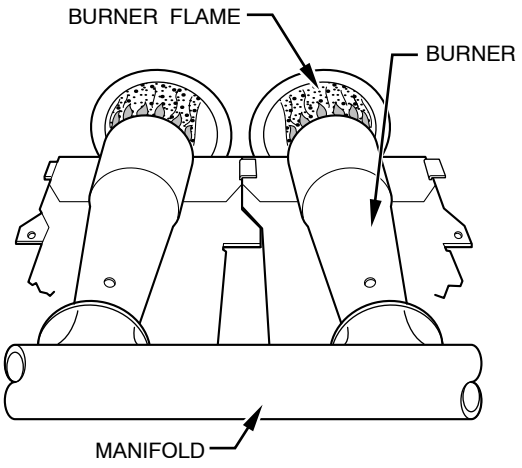

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Fig. 18—Burner Flame

Furnace must operate within range of temperature rise specified on the unit rating plate. Determine the air temperature rise as follows.

a. Place duct thermometers in return and supply ducts as near furnace as possible. Be sure thermometers do not "see" heat exchangers so that radiant heat does not affect thermometer readings. This is particularly important with straight-run ducts.

b. When thermometer readings stabilize, subtract return-air temperature from supply-air temperature to determine temperature rise.

c. Adjust air temperature rise by adjusting blower speed. Increase blower speed to reduce temperature rise. Decrease blower speed to increase temperature rise.

⚠ WARNING

Disconnect the electrical power before changing the speed tap. Failure to follow this warning could result in personal injury.

d. To change blower motor speed selections for heating mode remove blower motor lead from control board HEAT

terminal. (See Fig. 14.) Select desired blower motor speed lead from 1 of the other terminals and relocate it to HEAT terminal. See Table 10 for lead color identification. Reconnect original lead on SPARE terminal.

Follow this same procedure for proper selection of COOL speed selection.

⚠ CAUTION

If Model 58ZAV 115-22 is installed in 0.50-in. wc or lower static pressure ductwork, evaporator coil condensate blow off can occur during cooling operation. When installed in this manner, do not use high blower speed tap for cooling.

Table 10—Speed Selector

COLOR	SPEED	FACTORY-ATTACHED TO
Black	High	COOL
Yellow (When present)	Medium-High	SPARE
Blue	Medium-Low	HEAT
Red	Low	SPARE
White	Common	L2/COM

⚠ CAUTION

Recheck temperature rise. It must be within limits specified on unit rating plate. Recommended operation is at midpoint of rise or above.

3. Set thermostat heat anticipator.

   The thermostat heat anticipation must be set to match the amp draw of the electrical components in the R-W circuit. Accurate amp draw readings can be obtained at thermostat subbase terminals R and W. Fig. 19 illustrates an easy method of obtaining the actual amp draw. The amp reading should be taken after the blower motor has started. See the thermostat manufacturer's instructions for adjusting the heat anticipator and for varying the heating cycle length.

NOTE: When using an electronic thermostat, set cycle rate for 3 cycles per hr.

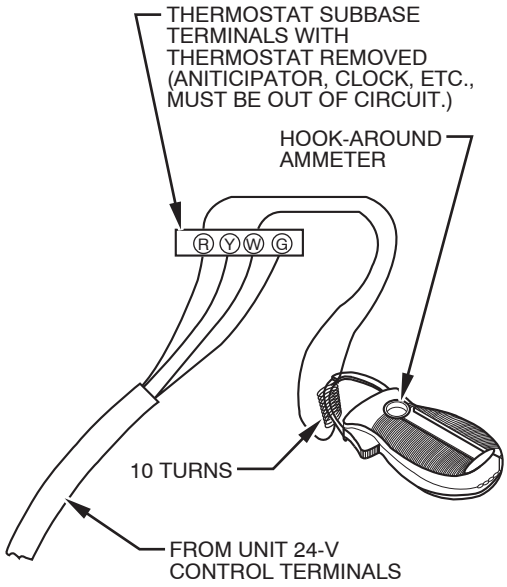

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Fig. 19—Amp Draw Check With Ammeter

CHECK SAFETY CONTROLS

The flame sensor, gas valve, and pressure switch were all checked in the Start-up Procedures section as part of normal operation.

1. Check primary limit control.

   This control shuts off the combustion control system and energizes the circulating-air blower motor if the furnace overheats.

   The preferred method of checking the limit control is to gradually block off the return air after the furnace has been operating for a period of at least 5 minutes. As soon as the limit has shut off the burners, the return-air opening should be unblocked. By using this method to check the limit control, it can be established that the limit is functioning properly and operates if there is a motor failure.

2. Check blocked vent safeguard switch.

   The purpose of this control is to permit the safe shutdown of the furnace during certain blocked vent conditions.

   a. Disconnect power to furnace and remove vent connector from furnace outlet collar. Be sure to allow time for vent pipe to cool down before removing.

   b. Restore power to furnace and set room thermostat above room temperature.

   c. After normal start-up, allow furnace to operate for 2 minutes, then block flue outlet 100 percent. Furnace should cycle off within 2 minutes.

   d. Remove blockage and reconnect vent pipe to furnace outlet collar.

   e. Wait 5 minutes and then reset blocked vent safeguard switch.

3. Check pressure switch.

   This control proves operation of draft inducer blower.

   a. Turn off 115-v power to furnace.

   b. Remove control door and disconnect inducer motor lead wires from wire harness.

   c. Turn on 115-v power to furnace.

d. Set thermostat to "call for heat" and wait 1 minute. When pressure switch is functioning properly, hot surface igniter should NOT glow and control diagnostic light flashes a status 31. If hot surface igniter glows when inducer motor is disconnected, shut down furnace immediately. Determine reason pressure switch did not function properly and correct condition.

e. Turn off 115-v power to furnace.

f. Reconnect inducer motor wires, replace control door, and turn on 115-v power to furnace.

4. Check auxiliary limits (when used).

a. Turn off 115-v power to furnace.

b. Remove blower access door.

c. Disconnect red motor lead at blower speed selector. Mark terminal for proper reconnection.

d. Replace blower access door.

e. Turn on 115-v power to furnace. Be sure room thermostat is calling for heat.

f. Allow furnace to operate until auxiliary limit activates, but DO NOT operate furnace longer than 4 minutes.

g. If furnace operates for 4 minutes, check/replace limit switch(es).

h. Turn off 115-v power to furnace.

i. Remove blower access door.

j. Reconnect red motor lead, reset switch, and replace door.

k. Turn on 115-v power to furnace.

CHECKLIST

1. Put away tools, instruments, and clean up debris.
2. Verify manual reset switches have continuity.
3. Ensure blower and control access doors are properly installed.
4. Cycle test furnace with room thermostat.
5. Check operation of accessories per manufacturer's instructions.
6. Review User's Manual with owner.
7. Leave literature packet near furnace.

CHECKLIST—INSTALLATION

LOAD CALCULATION

_____ Heating Load (Btuh)

_____ Cooling Load (Btuh)

_____ Furnace Model Selection

AIR FOR COMBUSTION AND VENTILATION

_____ Unconfined Space

_____ Confined Space

VENTING

_____ NFGC (United States)

_____ NSCNGPIC (Canada)

_____ Local Codes

_____ 1/4-in. Upward Slope

_____ Joints Secure

_____ See Attached Vent Table Instructions

CHECKLIST—START-UP

_____ Gas Input Rate (Set Within 2 percent of Rating Plate)

_____ Temperature Rise Adjusted

_____ Thermostat Anticipator Setting Adjusted or

_____ Thermostat Cycle Rate (3 cycles per Hr)

CHECK SAFETY CONTROLS OPERATION

_____ Primary Limit

_____ Pressure Switches

_____ Draft Safeguard Switch

_____ Auxiliary Limit Switch(es)

SERVICE TRAINING

Packaged Service Training programs are an excellent way to increase your knowledge of the equipment discussed in this manual, including:

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